

What is claimed is:

1. A structural assembly or component comprising:

a pair of outer skins or laminates, each formed from layers or plies of continuous fiber-reinforced composite;

an inner structure located between the outer laminates such that the outer laminates are coupled together;

a series of understructure details consisting of unimpregnated or partially impregnated woven material; and

a series of understructure details which are tapered and each of which is supported by a suitable mandrel during handling and prior to cure of a thermosetting resin that is infused.

2. The structural assembly or component of claim 1 wherein the understructure is formed from braided fibers.

3. The structural assembly or component of claim 1 wherein the understructure is formed from woven fibers.

4. The structural assembly or component of claim 1 wherein the understructure is formed by braiding "socks" or "sleeves" over mandrels that define the internal geometry of the finished substructure.

5. The structural assembly or component of claim 1 wherein the outer skins or laminates are composed of layers of unimpregnated continuous fiber materials.

6. The structural assembly or component of claim 1 wherein the outer skins or laminates are composed of layers of unimpregnated continuous fiber materials intermixed with layers of fully impregnated continuous fiber materials.

7. The structural assembly or component of claim 1 wherein the outer skins or laminates are

1 composed of some layers of unimpregnated continuous fiber materials intermixed with some layers
2 of fully impregnated continuous fiber materials and some layers of partially impregnated continuous
3 fiber materials.
4

5 8. The structural assembly or component of claim 1 wherein the outer skins or laminates are
6 composed completely of layers of fully impregnated continuous fiber materials.
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8 9. The structural assembly or component of claim 8 wherein a layer of uncured film adhesive
9 is placed on the inner surface or each skin to toughen the cured interface between the skins and the
10 understructure.
11

12 10. A structural assembly or component comprising:
13 external skins or laminates joined to a series of contiguous structural channels or tubes or
14 beams; and
15 unitized by composite structural details joined by cured thermosetting resin that provides
16 mechanical integrity without use of mechanical fasteners.
17

18 11. The structural assembly or component of claim 10 wherein the resin permeates the structure
19 leaving few or no voids.
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21 12. The structural assembly or component of claim 10 wherein the resin is injected or transferred
22 into the structure.
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24 13. The structural assembly or component of claim 10 wherein the inner and outer mold lines
25 of each skin are accurately defined and held to close dimensional tolerances defined by a matched
26 mold.
27

28 14. The structural assembly or component of claim 10 wherein the internal structural details are
29 dimensionally accurate and defined by dimensions and geometry of mandrels or similar tooling

1 details.

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3 15. A method for fabricating a structure or component comprising the steps of:

- 4 (a) creating skins or laminates by laying layers of plies of continuous fiber materials
5 containing a low resin content of less than 20% by weight;
6 (b) braiding or weaving unimpregnated fibers to conform to the external shape of
7 mandrels;
8 (c) placing one skin onto the inner face of one half of a matched mold;
9 (d) placing the over-braided or over-woven mandrels onto the skin so that they are
10 contiguous with one another;
11 (e) placing the other skin onto the top of the over-braided or over-woven mandrels;
12 (f) placing the other half of the matched mold over the skin of step (e) so that the inner
13 face of the mold half is against the skin;
14 (g) placing the resulting tooling/component assembly into a hydraulic press and applying
15 a compacting force that results in mold closure;
16 (h) sealing the mold and drawing a vacuum inside the closed mold;
17 (i) heating the mold, injecting resin into the mold to completely fill void areas, and
18 pressurizing the resin to a level sufficient to suppress formation of voids that could
19 be caused by moisture, solvents, or volatile reaction products; and
20 (j) heating the mold to a temperature for a period sufficient to cause cure of the
21 thermosetting resin, removing the top half of the mold, withdrawing the internal
22 mandrels or similar tooling details, and removing the part from the mold.

23
24 16. The method of claim 15 wherein the skins are formed by laying fully impregnated strips of
25 continuous fiber material using automated machine methods.

26
27 17. The method of claim 15 wherein the skins are formed by laying fully impregnated layers of
28 continuous fiber material.
29

1 18. The method of claim 15 wherein the skins or laminates are formed by intermixing layers of
2 low resin content layers and unimpregnated layers.

3
4 19. The method of claim 15 wherein the skins are formed by intermixing layers of partially
5 impregnated and fully impregnated continuous fiber materials.

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7 20. The method of claim 15 wherein the skins are formed by intermixing layers of partially
8 impregnated and unimpregnated continuous fiber materials.

9
10 21. The method of claim 15 wherein the skins are formed by intermixing layers of fully
11 impregnated and unimpregnated continuous fiber materials.

12
13 22. The method of claim 15 wherein the skins are formed by intermixing partially, fully, and
14 unimpregnated layers of continuous fiber materials.

15
16 23. The method of claim 15 wherein the skins are formed from material selected from the group
17 consisting unimpregnated continuous fibers, partially unimpregnated continuous fibers, fully
18 unimpregnated continuous fibers, and unidirectional fabric and woven fabric.

19
20 24. The methods of claim 15-23 wherein the layers formed the skins are not debulked prior to
21 closing the mold in the press.

22
23 25. The methods of claim 15-23 wherein the layers forming the skins are debulked prior to
24 closing the mold in the press.